B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2010

01571

ET-101(B) : MATHEMATICS-II (Probability & Statistics)

Time : 3 hours *Maximum Marks : 70*

Note : *All questions are **compulsory**. Use of calculator is allowed. Use statistical tables wherever necessary.*

1. Answer *any six* of the following : **6x5=30**

(a) If A and B are any two events such that

$$P(A) = \frac{1}{3}; P(B) = \frac{3}{4}; P(A \cup B) = \frac{11}{12};$$

find

(i) $P\left(B/A\right)$ (ii) $P(\overline{A} \cap B)$.

(b) In a bolt factory, machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their output 5%, 4% and 2% respectively are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B and C ?

(c) The probability that a new airport will get an award for its design is 0.16, the probability that it will get an award for its efficient use of materials is 0.24 and the probability that it will get both the awards is 0.11.

(i) What is the probability that it will get atleast one of the two awards ?

(ii) What is the probability that it will get only one of the two awards ?

(d) A toy is rejected if the design irrespective of it being faulty or not. The probability that the design is faulty is 0.1 and that the toy is rejected because of faulty design is 0.95 and otherwise is 0.45. If a toy is rejected, what is the probability that it is due to faulty design ?

(e) If two dice are thrown, what is the probability that the sum is :

(i) greater than 8, and

(ii) neither 7 nor 11 ?

(f) A random variable X has the following probability function.

$X = x$	0	1	2	3	4	5	6	7
$p(x)$	0	a	2a	2a	3a	a^2	$2a^2$	$7a^2+a$

(i) Find 'a'.

(ii) Evaluate $p(x \geq 6)$, $p(x < 6)$, and $p(1 < x < 5)$

(iii) If $p(x \leq a) > \frac{1}{2}$, find the minimum value of a.

(g) At a nuclear plant tests are performed to check corrosion inside the cooling pipes. The test has probability 0.7 of detecting corrosion when it is present but it has probability 0.2 of falsely indicating corrosion. Suppose the probability that any section of pipe has corrosion is 0.1.

(i) Find the probability that a section of pipe has corrosion, given that the test indicates its presence.

(ii) Find the probability that a section of pipe has corrosion given that the test is negative.

(h) Find 'K' so that the following can serve as probability distribution function of a random variable.

$$f(x) = \begin{cases} 0, & \text{for } x \leq 0 \\ Kxe^{-4x^2}, & \text{for } x > 0 \end{cases}$$

(i) A discrete random variable X has the following distribution :

X:	1	2	3	4	5	6
$p(x)$:	0.1	0.15	0.2	0.25	0.15	0.15

Find E (X) and Var (X).

2. Answer *any two* of the following : **2x10=20**

(a) In a certain factory turning razor blades, there is a small chance of $\frac{1}{500}$ for any blade to be defective. The blades are in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing

(i) no defective

(ii) one defective, and

(iii) 2 defective blades respectively in a consignment of 1000 packets.

(b) If the probability that a fluorescent lamp has a useful life of atleast 800 hours is 0.9, find the probabilities that among 20 such lamps

(i) exactly 18 will have a useful life of at least 800 hours;

(ii) atleast 15 will have a useful life of atleast 800 hours;

(iii) atleast 2 will not have a useful life of atleast 800 hours.

(c) A sortie of 20 aeroplanes is sent on operational fight. The chances that an aeroplane fails to return is 5%. Find the probability that :

(i) one plane does not return

(ii) at the most five planes do not return

(iii) what is the most probable number of returns ?

3. Answer *any two* of the following : **2x10=20**

(a) During testing in a sample of 300 chips, 10 have been found to be defective. Can the manufacturer's claim that 2% of the chips are defective may be accepted ?

(b) Out of the twenty persons who were reported to be attacked by brain fever only eighteen survived. Using the large sample test, test the hypothesis at 5% level that if, attacked by brain fever survival rate is 85% against the alternative that it is more.

(c) The specifications for a certain kind of ribbon call for a mean breaking strength of 180 kg. If five randomly selected pieces of the ribbon have a mean breaking strength of 169.5 kg with a standard deviation of 5.7 kg, test the null hypothesis $\mu = 180$ kg against the alternative hypothesis $\mu < 180$ at 5% level of significance.